Contents

Abstract v

Acronyms and Abbreviations xv

Preface xvii

1 Introduction 1

1.1 Motivation 1
1.2 Research Approach 4
1.2.1 Hypothesis 4
1.2.2 Objectives 5
1.2.3 Limitations. 6
1.3 Methodology 7
1.4 Contributions. 8
1.5 Research Projects and Partners. 11

2 State of the art 13

2.1 Introduction 14
2.2 Background 15
2.2.1 Virtual Agents 15
2.2.2 Virtual Agents in mental health Care 16
2.3 Survey Method. 17
2.3.1 Goal definition 17
2.3.2 Search Strategy 17

2.3.3 Eligibility criteria . . . 18
2.4 Results . . . 19
2.4.1 Scenario 1: Mental health disorders supported by virtual agents and virtual environments . . . 20
2.4.2 Scenario 2: Intelligent, social and embodied conversational agents in mental health . . . 24
2.5 Conclusions . . . 37

3 Management and Planning of Session Contents 41
3.1 Introduction . . . 42
3.2 Related Work . . . 44
3.3 Functionality requirements . . . 47
3.4 Design of a modular architecture . . . 49
3.4.1 The Data Analysis Module (DA) . . . 50
3.4.2 The Knowledge Extraction Module (KE) . . . 52
3.4.3 The Knowledge Inference Module (KI) . . . 55
3.4.4 The Session Planner Module (SP) . . . 56
3.5 Evaluation . . . 60
3.5.1 Definition of scenarios . . . 62
3.5.2 Variables and evaluation space for simulations . . . 64
3.5.3 Evaluation of the adaptability . . . 65
3.5.4 Evaluation of the variability . . . 67
3.6 Discussion and Conclusions . . . 69

4 Modeling Therapeutic Empathy 73
4.1 Introduction . . . 74
4.2 An Emotional Virtual Agent to Support Patients with Major Depression . . . 76
4.3 Emotion Regulation . . . 79
4.3.1 Theoretical Foundations . . . 79
4.3.2 Computational Models of Emotion Regulation . . . 80
4.4 Adapting a Model of Two Emotion Regulation Strategies . . . 81
4.4.1 Modelling Cognitive Change - Reappraisal . . . 82
4.4.2 Modelling Response Modulation - Suppression . . . 86
4.5 Discussion and Conclusions . . . 88

5 Evaluation: Case of Study I (Treatment) 91
5.1 Introduction . . . 92
5.2 Related Works . . . 93
5.3 Framework . . . 94
5.3.1 Content Management Module . . . 96
5.3.2 Emotional Module . . . 99
5.4 Case of Study . . . 101
5.4.1 Pilot 1: Evaluation of the first prototype with recovered users . . . 104
5.4.2 Pilot 2: Evaluation of the second prototype with depressed patients. . . . 107
5.4.3 Pilot 3: Evaluation of the full system in Randomized Controlled Trial (RCT) . . . 113
5.5 Discussion and Conclusions . . . 121

6 Evaluation: Case of Study II (Prevention) 125
6.1 Introduction . . . 126
6.2 Related Work. . . . 127
6.3 Framework . . . 130
6.3.1 Content Management Module . . . 131
6.3.2 Emotional Module . . . 134
6.3.3 Visualization Component . . . 135
6.4 Case of study. . . . 136
6.4.1 Objective . . . 136
6.4.2 Participants . . . 137
6.4.3 Evaluation . . . 137
6.5 Results . . . 140
6.5.1 Quantitative findings. . . . 140
6.5.2 Qualitative findings . . . 144
6.6 Discussion and Conclusions . . . 148

7 Conclusions and Future Work 149
7.1 Conclusions . . . 150
7.2 Future Work . . . 152

Bibliography 155